



**THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Patent Application of
ROHR et al
Serial No. 09/955,297
Filed: September 19, 2001
For: PHOTOVOLTAIC DEVICE

Appeal No.: 2006-2150
Atty. Ref.: 550-269
TC/A.U.: 1753
Examiner: Brian Mutschler

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February 8, 2007

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Commissioner for Patents
P.O. Box 1450
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REQUEST FOR REHEARING
PURSUANT TO TITLE 37, PART 41.52

Sir:

Appellants respectfully request rehearing in the above identified Appeal on the grounds that the Decision of the Board of Appeals and Interferences mailed December 8, 2006 (the "Decision") does not consider or rebut the factual evidence of record in this appeal, i.e., the specification evidence as filed or the Rule 132 Declaration of Dr. Anderson (the "Declaration") as noted in more detail below.

I. An independent declaration by an expert under Rule 132 must be considered and any PTO rebuttal must be based upon evidence and not mere argument

The law regarding declaration evidence under Rule 132 is well settled by the former Court of Customs and Patent Appeals and its predecessor, the Court of Appeals of the Federal Circuit. "It is unquestioned that such [declaration] evidence must be considered." *In re Beattie*, 24 USPQ2d 1040, 1042-43 (Fed. Cir. 1992). "Expert opinion is entitled to be given

consideration along with the other evidence on the issue of obviousness" *In re Mochel*, 176 USPQ 194, 196 (CCPA 1972).

Even if the PTO meets its burden of establishing a *prima facie* case of unpatentability, "[t]he PTO is required to reconsider its *prima facie* case in light of the applicant's rebuttal evidence and must make a decision based upon the record as a whole." *In re Reuter, Vickery and Everett*, 210 USPQ 249, 255 (CCPA 1981). "As competent evidence tending to show the nonobviousness . . . [the Declaration] must be accorded fair weight in the company of all other competent rebuttal evidence." *In re Piasecki and Meyers*, 223 USPQ 785, 790 (Fed. Cir. 1984). "If the applicant presents rebuttal evidence, the decision maker must consider all of the evidence of record (both supporting and that rebutting the *prima facie* case) in determining whether the subject matter as a whole would have been obvious." *In re Carleton*, 202 USPQ 165, 168 (CCPA 1979).

Every opinion statement by an expert must be treated as un-rebutted fact unless rebutted by evidence in the record. Neither the Examiner nor the Board have introduced any evidence (as opposed to Examiner and Board argument) in the record disputing any statement by Dr. Anderson. The Declaration establishes that Dr. Anderson is an expert in the field of the claimed invention (Dec. ¶¶1-4). Clearly, the fact statements must be considered and, if not disputed, taken as established.

The weight or credibility given to the undisputed facts set out in a Rule 132 Declaration can vary depending upon whether the Declarant is the inventor (perhaps the lowest level of credibility), a co-worker of the inventor, an employee of the assignee or a completely independent party (the highest level of credibility). Here Dr. Anderson is not a co-inventor or a co-worker, is not employed by the assignee and, indeed, is not even located in the same country

as the inventors and the assignee (Dec. ¶¶1-4). Thus, the undisputed facts set out in the Declaration by an independent expert must be taken as the most credible testimony.

As the “decision maker” the Board’s apparent failure to consider and give proper credibility to the statements in the specification as filed as well as the fact statements made by Dr. Anderson, must be taken as clear reversible error.

II. The significance of the claimed invention

It is possible that the Board, as well as the Examiner, did not understand the present invention or its significance. The present invention addresses a problem in the art of quantum well solar-cells and how to increase their solar conversion efficiency. Quantum wells each have two layers of different material which are applied over a substrate. Because of their differing materials, when one layer is deposited over the substrate lattice structure, it will be under compression and when the other layer is deposited it will be under tension (these stresses are due to the crystal lattice of the materials being different from the lattice of the substrate).

Increasing the number of quantum wells provides increases in the efficiency of solar energy collection. However, as the number of wells increases, the likelihood of crystal lattice dislocations increases as well and serves to limit the total number of wells. As noted in the Freundlich prior art reference and in the present specification (paragraph bridging pages 2-3), if the number of wells exceeds around 20, the dislocations are so great as to begin reducing the conversion efficiency.

The Ekins-Daukes reference attempts to address this problem by disclosing that one should choose materials and thickness values of the materials “to minimize the average strain.” That only the specific materials’ lattice constants and thicknesses are used by Ekins-Daukes to achieve the minimized average strain is readily apparent by reference to Equation (1) in column

1 of Ekins-Daukes page 4195 where the substrates lattice constant (here GaAs) is to be matched by the formula which involves only the material thicknesses (t) and the material lattice constants (a). Meeting this condition provides that the total strain of each quantum well and barrier combination on the substrate can be adjusted, i.e., the so-called “choose values to minimize the average strain” approach.

However, as noted in the present specification (paragraph bridging pages 2-3) and in Dr. Anderson’s Declaration (“insufficiently exact” ¶12), there are still problems with the Ekins-Daukes approach in that there is still a stress build-up which causes efficiency reducing dislocations.

The present co-inventors, including some of the authors of the Ekins-Daukes reference, found that the Ekins-Daukes problems can be avoided if, instead of using just minimum average strain, the elastic coefficients (C) of each of the materials is also taken into account in order to achieve “no shear force” rather than the “minimize the average strain” as in the Ekins-Daukes approach. It will be noted that claimed “no shear force on a neighbouring structure” approach is achieved in a preferred embodiment by the equations on page 12 of the specification which, in addition to the thickness (t) and lattice constant (a), also includes the material elastic stiffness coefficients (C). This provides a more exact lattice match between each quantum well period (the combination of the compressively strained layer and the tensilily strained layer) and the underlying substrate and ensures “no shear force.”

It should be understood that the Ekins-Daukes reference could only provide “no shear force” if it accidentally used materials which had the same elastic stiffness coefficients (C). The materials normally used in quantum well solar cells do not have similar elastic stiffness coefficients and there is no suggestion in Ekins-Daukes that similar elastic stiffness coefficients should be used or that elastic stiffness coefficients are even a parameter to be considered. In

fact, Ekins-Daukes would lead one of ordinary skill in the art to ignore this parameter rather than include it in the formula.

The distinction between what is disclosed in the Ekins-Daukes reference and what is claimed in the present claims was addressed in Appellant's Reply Brief and shown in the Exhibit 1 attached thereto (where x_1 and x_2 are the amounts of strain and k_1 and k_2 are the elastic stiffness coefficients). As stated in the Reply Brief, page 6, Exhibit 1 shows that "it is possible to have zero strain and yet substantial stress in the Ekins-Daukes I organization of elements." This is discussed in detail in the Reply Brief from page 6, line 6 to page 7, line 18 with reference to figures (a) and (b) with (b) clearly showing that with the deposited layers having different stiffness constants, even though the strains of the two different layers are balanced, there is still a net "stress." In the discussion between page 7, line 19 through page 8, line 20 the present invention is discussed and it is demonstrated that in figure (d) there is "no shear force on a neighboring structure."

Appellants' claimed interrelationship avoids the dislocation problem when high numbers of quantum wells are used to increase collection efficiency. For example, as discussed on page 6 of the specification as originally filed, the dislocation problem is avoided ("The number of quantum wells that can be incorporated is therefore not limited by the build-up of strain") and that solar cells of "30-60" quantum wells can be made – clearly providing significantly higher conversion efficiencies.

III. The Board's Decision ignores the Examiner's admission that "strain" does not equal "stress"

The Decision adopts the Examiner's "findings, conclusions, and rebuttals" as its own (Decision, page 4, line 1). The Examiner is on record as admitting that "strain is not the same as

stress" (Supplemental Examiner's Answer mailed August 8, 2005, page 2, line 9 recitation of Appellant's argument followed by the Examiner's statement "Appellant's arguments are well taken . . ." at lines 15-16). It is well known by mechanical engineers that stress is analogous to force and thus the claimed invention is a force balance (or zero stress) approach. This was explained in the current record in detail in the Appellant's Reply Brief filed November 22, 2004 as noted above and has not been subsequently rebutted by the Examiner or the Board.

The Ekins-Daukes reference discloses only choosing material and thickness values "to minimize the average strain" approach (Ekins-Daukes page 4195, Abstract line 1 and col. 2, line 1) and this is not disputed by the Examiner (although the Examiner goes to great lengths to argue that the Ekins-Daukes strains are very small and are negligible but provides no evidence that these small strains will not cause the dislocation problems noted in the Background of the Invention).

The background of the present invention in the record states that problem dislocations in the crystal lattice can be minimized by the Ekins-Daukes teachings (Specification, page 3, lines 1-7), but that such a "device providing an average lattice constant matching the substrate may still allow a significant build up of stress that will result in undesirable dislocations." (Specification, page 3, lines 20-22). The problem of dislocations caused by stress build up is not solved without a "zero stress condition" which requires taking into account the differences in elastic properties of the layers. (Specification, page 11, lines 21-25).

The only evidence of record is that Ekins-Daukes teaches only to "minimize the average strain." This fact (unrebutted by the Examiner and the Board), coupled with the Examiner's admission that "strain is not the same as stress" without any Board supplied evidence to the contrary, disputes any rational conclusion of inherency of the claimed "no shear force" approach set out in the independent claims 1, 18, 33 and 44 and claims dependent thereon.

The Board's ignoring of the "strain" only teaching in Ekins-Daukes and the Examiner's admission regarding stress and strain is reversible error.

IV. The Examiner and the Board's Decision fail to follow the requirements of the Manual of Patent Examining Procedure regarding unsupported allegations of "inherency"

In apparent acceptance of the fact that there is no evidence of record suggesting Appellants claimed "no shear force on a neighbouring structure" approach, Board's Decision specifically asserts that Ekins-Daukes teaching of the strain balance approach "will necessarily and inherently exert 'substantially no shear force on a neighboring structure' (claim 1) as required by the appealed claims." (emphasis added, Decision page 4, lines 5-6).

The Board's conclusion is not supported by the Ekins-Daukes reference nor by any other evidence of record (and is factually rebutted by the Declaration of Dr. Anderson). It should be noted that there is no mention of any "inherency" allegation until after the Reply Brief was filed by Appellant (November 22, 2004) which explained the well-known distinction between "stress" and "strain" and noted the difference between the Ekins-Daukes strain-balance approach and the claimed "no shear force" approach. The first allegation of "inherency" did not occur until the Supplemental Examiner's Answer mailed August 9, 2005. Pursuant to the Manual of Patent Examining Procedure (MPEP) §2144.03 this factual contention ("inherency") was immediately and properly challenged by the Appellant in the Supplemental Reply Brief filed October 7, 2005 (page 3, first full paragraph observing that the Examiner did not previously raise this "inherency" allegation and raising an objection that Applicant has not had an opportunity to object to this allegation during prosecution).

To date, neither the Examiner nor the Board has identified any evidence of record supporting the inherency argument. Such evidence is required by the MPEP, i.e., "Official

notice unsupported by documentary evidence should only be taken by the examiner where the facts asserted to be well-known . . . are capable of instant and unquestionable demonstration as being well known” §2144.03A; “Ordinarily, there must be some form of evidence in the record to support an assertion of common knowledge” §2144.03B; and “If Applicant challenges a factual assertion . . . the Examiner must support the finding with adequate evidence.” §2144.03C. To the extent the Board is adopting the Examiner’s unsupported allegation of “inherency” Appellant renews the traversal and requires an identification of any evidence of record that supports the Board’s holding of inherency

The Board and the Examiner have failed to identify any evidence supporting the Examiner’s “inherency” theory or explain how there can be any inherent teaching of a “no shear force” approach in view of the admission that “strain is not the same as stress” and the evidence of record showing that Ekins-Daukes only teaches to “minimize the average strain” approach. Thus a prima facie case “inherency” has not been made out by the Examiner or the Board and the holding thereof is reversible error as being completely unsupported by the present record.

V. The Board’s Decision that the Examiner’s position is supported by “fact and technical reasoning” is unsupported and in fact, controverted by the present record.

In the Decision, page 4, second full paragraph, the Board argues that the “Examiner’s position is reasonably supported by fact and technical reasoning.” However, the Board identifies no portion of the present record which presents any fact or technical reasoning which supports the “inherency” argument noted above nor, more importantly, does it traverse any portion of the Rule 132 Declaration of Appellant’s expert witness.

The Declaration establishes that: (1) the Examiner’s position that all claimed elements are present in Ekins-Daukes “is incorrect” (emphasis added, Declaration ¶10); (2) “the Examiner

errs in his conclusion that the requirement of claim 1 that ‘a period . . . exerts substantially no shear force on a neighboring structure’ is ensured by the Ekins-Daukes I disclosure . . .” (emphasis added, Declaration ¶11); and (3) the Ekins-Daukes “disclosure that the thickness-weighted average lattice constant of wells and barriers is roughly the same as the InP substrate but this is insufficiently exact to ensure periods which exert ‘substantially no shear force on a neighboring structure’ ” (emphasis added, Declaration ¶12). The failure of the Examiner and the Board to accept this fact testimony is unsupported by any fact evidence of record.

Both the Board’s ignoring the expert testimony of record and its failing to identify any countervailing evidence tending to dispute or test the credibility of the expert testimony of record is clearly reversible error.

VI. The Board’s Decision that the present invention, using the same compositions as in Ekins-Daukes will result in “substantially no shear force on a neighbouring structure” is unsupported by both logic and the present record.

In the Decision at page 4, second paragraph, the Board contends that the Examiner’s position (unidentified by the Board) “is reinforced , . . . , by the fact [alleged by the Board but unsupported by the record in this Appeal] that the appealed claims define the ‘substantially no shear force’ limitation as resulting from layer compositions which include those of Ekins-Daukes.”

Firstly, there is little or no logic associated with the above statement. Assuming *arguendo* that the same starting layer compositions are used both in Ekins-Daukes and in the claimed invention, there is no evidence of record that in Ekins-Daukes they are combined in a manner so as to achieve the claimed requirement of “substantially no shear force.” Simple logic dictates that, just because the same starting materials are used, the same result is not “inherently”

obtained, especially when different thickness parameters can be used (as in the claimed “no shear stress” approach instead of the Ekins-Daukes “minimize the average strain” approach).

Secondly, this contention is specifically traversed by the evidence of record establishing without rebuttal that Ekins-Daukes is “insufficiently exact to ensure periods which exert ‘substantially no shear force on a neighboring structure’.” (emphasis added, Declaration ¶12). This fact evidence is directly contrary to the Examiner’s and the Board’s conclusion and no disputing evidence has been identified by the Board.

Thirdly, the Board’s decision provides what it believes to be examples supporting its conclusion (that the same starting compositions necessarily result in the inventive combinations) by comparing “the compositions defined by appealed claims 12 and 13 with the compositions disclosed on page 4195 of the Ekins-Daukes reference.” As will be seen in the following detailed discussion, the Board’s Decision is simply incorrect.

Claim 13, cited by the Board as an example, does not even support the Board’s premise. The Board alleged that the subject matter of claim 13 is a “composition disclosed on page 4195 of the Ekins-Daukes reference.” However, claim 13 specifies that the “multiple quantum well portion is formed of layers of $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$,” and this same composition is completely missing from the Ekins-Daukes reference. Ekins-Daukes does disclose **InGaAs** layers (in the abstract, in the first column, 2nd and 3rd paragraphs, in equation (1) and in the second column first full paragraph and Fig. 1) and **GaAsP** layers (in the abstract, in the first column, 3rd paragraph and in equation (1) and in the second column first full paragraph and Fig. 1). However, nowhere in Ekins-Daukes is there any reference to a **InGaAsP** layer.

Claim 12 species that the “substrate is GaAs” which is a substrate used in page 4195 Ekins-Daukes and is analogous to the “neighboring structure” set out in claims 1, 18, 33 and 44.

Since each claim has “substantially no shear force on a neighboring structure, ED1 merely identifies the “neighboring structure.” This identification of the substrate says nothing about the claimed interrelationship of the layers in each “period” or the period’s relationship with the “neighboring structure” as set forth in independent claims 1, 18, 33 and 44.

Thus the Board’s allegation that starting with the same materials somehow mandates the same result with the claimed interrelationship is faulty logic, the Board’s contentions are rebutted by the Declaration evidence that Ekins-Daukes is “insufficiently exact” to achieve the claimed interrelationship and the Board’s examples are either erroneous and/or do not support its premise. These defects in logic, fact and example clearly demonstrate the reversible error of the Board’s decision.

VII. Appellants have already responded to the Examiner’s and the Board’s Decision’s new requirement of addressing “the exact solar cell” and the “specific compositions,” respectively, disclosed in the Ekins-Daukes reference.

The Board alleges in the Decision, on page 5, first full paragraph, that there is a requirement that the briefs and the Anderson Declaration address the “specific compositions” in the Ekins-Daukes reference and that this requirement has not been met.

The allegation that the Declaration does not address the specific compositions disclosed in the Ekins-Daukes reference is not in the appealed from Final Rejection of January 21, 2004 nor even in the Examiner’s Answer mailed September 21, 2004. A tangential issue was raised in the Supplemental Examiner’s Answer of August 8, 2005 with the Examiner arguing that the Declaration “paragraph 12 does not address the **exact solar cell** prepared in Ekins-Daukes . . .” (page 5-6 and repeated in the further Supplemental Examiner’s Answer of December 23, 2005 at page 16). The declaration testimony is that regardless of what is disclosed in Ekins-Daukes, the disclosure “is insufficiently exact” to achieve the claimed combination of structures. Again

simple logic would dictate that, if the entire Ekins-Daukes document is “insufficiently exact” every sub-set of that document, including the specific compositions and the “exact solar cell prepared in Ekins-Daukes” is insufficiently exact to disclose the claimed combination of structures.

Without any support in the record, the Board erroneously opined, but without any evidentiary support, that “Appellants in their Briefs and Dr. Anderson in his Rule 1.132 Declaration have failed to address the specific compositions disclosed by Ekins-Daukes.” Appellants Briefs were all filed before the Board raised this issue for the first time in its Decision. The Board has cited no precedent establishing this as a new requirement of a Rule 132 declaration nor is there any rational logic which would require such detailed consideration.

Furthermore, the Board’s new requirement would be clearly erroneous in the situation where the invention may be a new combination and interrelationship of otherwise known elements. This would certainly be true in the present case where the interrelationship must be such that “a period of one tensile strained layer and one compressively strained layer exerts substantially no shear force on a neighbouring structure.” Any recently Board perceived failure to address each of the compounds disclosed in Ekins-Daukes does not disqualify the Declaration of an expert witness.

Finally, a review of the Ekins-Daukes reference will identify that it discusses and/or discloses only the following “specific compositions” (as noted by the Board): (1) GaAs, (2) GaAsP, (3) InGaAs, (4) GaAs_{0.939}P_{0.061}, and (5) In_{0.17}Ga_{0.83}As. The Declaration statement about “every element” in the Ekins-Daukes reference of necessarily includes the above “specific compositions.” The expert testimony of Dr. Anderson that “the Examiner’s suggestion that every element set out in claims 1-6, 12, 13, 42 and 43 is present in the Ekins-Daukes reference . . . is incorrect” (Declaration paragraph 10). Since the Declaration paragraph 10 addresses Ekins-

Daukes in its entirety, it clearly includes each of the compositions and the Board's erroneous test has been met.

Dr. Anderson's expert testimony in paragraph 10 of the Declaration establishes that the Examiner erred in alleging that "every element set out in claims 1-6, 12, 13, 42 and 43 is present in the Ekins-Daukes reference . . ." His expert testimony in paragraph 11 of the Declaration establishes that the "Examiner errs in his conclusion that the requirement of claim 1 [relating to "substantially no shear force"] is ensured by the Ekins-Daukes I disclosure . . ." As a result of the testimony relating to Ekins-Daukes overall, there is no requirement to address each composition set out in the reference and in any event, the Declaration complies with such requirement.

VIII. Without identification of any evidence, the Board's Decision erroneously concludes that a prima facie case of patentability has been made by the Examiner

The Board, as noted above, concludes, without any supporting evidence, that "the Examiner has established a prima facie case for his inherency position" and that "it is appropriate to require Appellants to prove that the solar cells disclosed by Ekins-Daukes do not necessarily or inherently posses the 'substantially no shear force' characteristics . . ." (Decision, page 4).

The lack of a prima facie case any "inherency" argument has been noted above in section III since no evidence has been cited by the Examiner or the Board in response to Appellant challenge under MPEP §2144.03. However, even if a prima facie case were to have been made, it has been rebutted by the expert testimony of Dr. Anderson which states in paragraph 12 of the Declaration that the "Ekins-Daukes I disclosure . . . is insufficiently exact to insure periods which exert 'substantially no shear force on a neighboring structure'." This is the testimony of an expert witness which has never been rebutted by the Examiner and addresses the entire Ekins-

Daukes reference. It fully and completely proves the Examiner's allegation of "inherency" to be incorrect and, absent the "inherent" disclosure, there can be no *prima facie* case.

The Board's apparent ignoring of this unrebutted evidence is clearly reversible error.

IX. The Board's Decision's suggestion that a further Rejection under §112 be raised by the Examiner, ignores the record in this case as this exact rejection was withdrawn in the first Final Rejection

The Board, in the page 5 footnote of the Decision, alleges that "as correctly indicated by the Examiner in his Answers and not disputed by the Appellants, the subject specification contains no definition or guidance as to the scope of shear force encompassed by the claim term 'substantially'." Firstly, this issue was raised by the Board at the Oral Hearing and is not contained anywhere in the Appealed from Final Rejection.

Secondly, this rejection was previously raised by the Examiner in the first official action mailed August 2, 2002 page 3, section 5 when he alleged that the use of the language "substantially" in the claims made them indefinite. This rejection was rebutted in the Amendment filed January 2, 2003 and specifically, on page 8, the Examiner's attention was directed to the MPEP section 2173.05(b) which identifies several court cases holding that use of the word "substantially" is definite. In the following action - the Final Rejection mailed January 27, 2003, page 2, section 3, - the Examiner held that "Applicant's remarks clarifying the definition of the term "substantially" have been found acceptable" and the rejection under §112 "has been withdrawn."

Thirdly, the Board's proposed "new" rejection under section 112 further evidences the apparent fact that the Board has not reviewed the entire record in this case and in particular other sections of the Declaration of Dr. Anderson. In paragraph 9 (b) Dr. Anderson found that "the specification clearly does enable one of ordinary skill to practice the claimed invention." Thus,

whatever “substantially” means, it is known to those of ordinary skill and Dr. Anderson’s testimony confirms this fact.

Thus, not only has the issue not been raised by the Examiner in the appealed-from Final Rejection, it was previously raised and then withdrawn by the Examiner (some 4 years ago). Moreover, the expert testimony by Dr. Anderson of record indicates that one of ordinary skill would understand the claim term. Thus any future rejection on this basis would be ill-advised.

Summary of the Request For Rehearing

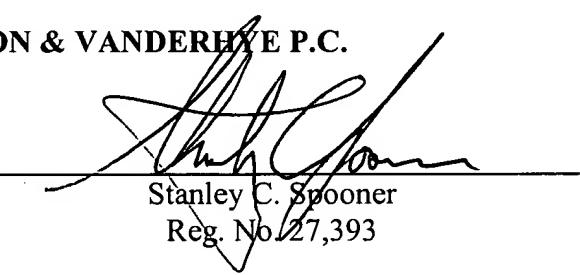
The review of the Board’s Decision indicates that the Board has either ignored, failed to consider or failed to appropriate weight to the testimony of Appellants’ expert witness, Dr. Anderson. The Examiner’s admission of record and finding that “strain is not the same as stress” is binding upon the Board (in the absence of any record evidence to the contrary) and this admission confirms that Ekins-Daukes’ teaching of “minimize the average strain” approach is not the same as the claimed “no shear force” approach.. When the inherency argument was first raised (after Appellants Reply Brief and in the Examiners Supplemental Examiner’s Answer), Appellant tested the allegation under MPEP §2144.03 and neither the Examiner nor the Board has provided any evidentiary support for the allegation. While the Decision is long on conclusory statements indicating the Examiner’s position is supported by “fact and technical reasoning,” neither the Board or the Examiner identifies any evidence in the record supporting a *prima facie* case and, even if it had, any such case has clearly been rebutted by the Declaration evidence. Just about the only actual factual basis alleged in the Decision, i.e., that the subject matter of Claim 13 (“InGaAsP”) is disclosed in the Ekins-Daukes reference, is factually incorrect. Not only does the Declaration evidence address the Ekins-Daukes reference, it includes the disclosed “exact solar cell” and the “specific compositions.” Thus the Declaration not only suggests the lack of a *prima facie* case, but also rebuts any such alleged case.

Based upon the above, rehearing and reconsideration of the Decision is requested in order to set forth the Board's legal and factual holdings upon which it bases its decision for the purpose of Appeal or to properly permit Appellant to respond to issues raised after completion of briefing in this Appeal.

Respectfully submitted,

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